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Construction Materials Testing and Documentation Guide

The City of Wilmington promotes the development of sustainable infrastructure and provides the following guidance on construction materials testing (CMT) and documentation practices for roadway and underground utility construction.

Materials Testing and Documentation Guide

This guide implements quality control (QC) requirement during construction by providing the minimum applications, targets and frequencies. Additional requirements may be required for necessary to meet industry standards. Generally, CMT services shall be provided by the Utility/Owner separately from the construction contractor, i.e. another 3rd party specializing in testing procedures. The various testing reports and material documents shall be complimentary to provide complete assurance. Other unique conditions or design specifications such as NCDOT standards may apply and could supersede this policy. Without other specific instructions, the following guidelines include:

- Table 1 is attached as a minimum guide to assist with CMT plans and testing resources on a project. Other needs not listed may exist.
- Utility/Owner must coordinate CMT plans before and during construction with the City.
- Utility/Owner shall ensure coordination of test schedules and communication of test results within 48 hours with City Inspector or other responsible personnel.
- Utility/Owner shall manage failing/non-passing tests to rectify situation with contractor(s) and ensure a passing result is obtained.
- Where failing tests occur or no conclusive passing tests exist, the City reserves the right to require further testing or retests, at no cost to the City.
- As part of construction deliverables, copies of test reports, submittals or other requested documents shall be furnished to the City. Such reports shall be professional, organized and shall typically contain the following:
    - Written Summary of Results
    - Test Reports- (compiled/quantified by test type, time, etc.)
    - Materials Received Reports – (submittals, certifications, truck tickets, etc.)
- This guide does not release the utility, owner or contractor from completing all the necessary submittals, construction steps, inspection and testing necessary to meet the standard details, policies and specifications required for all products used for the installation of public infrastructure.

Table 1 - Materials Testing and Documentation Guide					
Test Type:	Application:	Test Target:	Frequency and Test Sections:	Method/Spec:	Documentation:
Soils					
Lab Tests					
Soil Proctors	'Unit Weight" necessary for soil density tests	Maximum Dry Density (MDD) Optimum Moisture Content (OMC)	backfill and grading materials each project, where soils change	AASHTO T-99(standard) AAHSTO T-180(modified) ASTM D-698(standard) ASTM D-1557(modified)	Soil Profile Tests (lab)
Field Tests					
Proof roll for undercut soil	subgrade	visual check of stability and uniformity	within 7 days of stone laydown and no rain	Loaded tandem truck (typ.)	Proof roll report
Compaction for Backfill-Nuclear Gauge	embankments	≥ 95% compaction	1 / block or every 500'	NCDOT STD Specs	Test Result reports
	pipe trench and overfill	≥ 95% compaction	per lift (12" max.) every 100'	NCDOT Nuclear Density Testing Manual - Base Course/Select Materials	
	subgrade (final 12" fill)	≥ 98% compaction	4 / block or every 500' where pvmt ≤ 32' width or 8 / block or every 500' where pvmt ≥ 32' width	Nuclear Gauge Testing-ASTM D-6938	
Compaction - alternates	see above	see above	see above	Sand Cone Method - ASTM D-1556 or; Ballon Density-ASTM D-2167	Test Result reports
Dynamic Cone Penetrometer	excavations, shallow foundations	bearing capacity # blow counts	areas of proposed shallow foundation	ASTM STP - 399	Test Result reports
Stone					
Lab Tests					
Stone Proctors	'Unit Weight" necessary for stone density tests	Maximum Dry Density (MDD) Optimum Moisture Content (OMC)	road base (ABC) and backfill materials	AAHSTO T-180(modified) ASTM D-1557(modified)	Soil Profile Tests (lab) or NCDOT M&T certifications
Field Tests					
Stone Delivery/Laydown	subgrade, backfill areas, rip rap, etc.	check of spread rate/thickness verify product	install and maintain, avoid saturation compaction required within 48-hours	NCDOT STD Specs Section 1000	Collect truck tickets
Fine grading	subgrade	± 1/2 inch of grades	7 days max. prior to asphalt laydown and no rain	check stakes construction survey	Daily Inspection reports
Compaction - Nuclear Gauge	road base (ABC)	≥ 98% compaction	4 / block or every 500' where pvmt ≤ 32' width or 8 / block or every 500' where pvmt ≥ 32' width	NCDOT Nuclear Density Testing Manual - Base Course/Select Materials	Test Result reports
	curblines (ABC)	≥ 98% compaction	4 / block or every 500'	Nuclear Gauge - ASTM D-6938	

Test Type:	Application:	Test Target:	Frequency and Test Sections:	Method/Spec:	Documentation:
Concrete					
Lab Tests					
Concrete Mix Design	curbing, sidewalks, driveways	strength (psi) of concrete required by contract	proprietary standards (each plant) or Form 312U Mix design.	NCDOT STD Specs Section 1000	Proprietary mix or JMF
Compressive Strength	curbing, sidewalks, driveways	breaks results ≥ required strength (Class AA, 4500psi) (Class A, 3000psi) (Class B, 2500psi)	pass/fail 7 day break (typically ≥ 75% of strength) 28 day break ≥ design strength average of 2 cyclinders	ASTM C39	Concrete Break reports
Field Tests					
Concrete Delivery/Pour	curbing, sidewalks, driveways	check forms, grades verify product	Common test sequence below:	NCDOT STD Specs Section 1000	Collect truck tickets
Air Test		5.0 ±1.5%, per mix design	truck #1; air, slump, temp, cylinders	Pressure Air Meter - ASTM C231	Daily Inspection reports
Slump Test		up to 5", per mix design	trucks #2-4; air	Slump Test - ASTM C143	Test Result reports
Temperature	concrete/ ambient temp.	concrete delivered ≥ 50° and ≤ 95° air temp to be ≥ 35°	truck #5; air, slump		
Cylinder Making & Curing	see above	4" x 8" cylinders typical	5 cylinders per day/batch for every 50 cubic yards	Sampling & Testing ASTM C172; ASTM C31; ASTM C39	When needed: NCDOT M&T 903 (Batch Tix) 250 Daily Plant Report
Asphalt					
Lab Tests					
Asphalt Mix Design	roadway/path	surface layer up to 3" depth intermediate up to 4" depth base layer up to 8" depth	NCDOT asphalt standards	NCDOT STD Specs Section 600 NCDOT Asphalt QMS Manual	Standard mix type or JMF
Field Tests					
Asphalt Delivery/Laydown	roadway/path	check stakes, grades check asphalt temperatures	observe each layer and paver laydown Air temp 40° in the shade and rising	NCDOT STD Specs (see above)	Collect truck tickets
Temperature	on hauling trucks	Typical 225° to 315° (± 25° of JMF from the plant)	test before placement, also, no wet pavement affecting bonding		Asphalt Daily Reports: City Report or NCDOT M&T 605
Density - Nuclear Gauge	roadway/path	90% density - S9.5B 92% density - S9.5C, S9.5D, I19.0C, B25.0C	QC = 5 nuclear gauge shots per 500'/each paver laydown width / lot QA = verification	NCDOT Nuclear Density Manual ASTM D-2950	Test Result reports
Core control and control strips when needed		thickness & density requirements	For control strip reference NCDOT Standard Specs Section 609-7 QC = 1 core check per 500'/each paver laydown width	Bulk Density (Cores) - ASTM D-2726	When needed: NCDOT QA/QC-5, QC-5, QA-515, 516QC, etc.